

Section 641 Sign Bridges and Overhead Sign Supports

641.1 Description

- (1) This section describes providing sign bridges and overhead sign supports.

641.2 Materials

641.2.1 General

- (1) Unless specified otherwise, the contractor may furnish either aluminum sign bridges, or zinc coated steel sign bridges.

641.2.2 Steel Bolts

641.2.2.1 High-Strength Bolts

- (1) Furnish zinc-coated type 1 bolt/nut/washer assemblies for field tensioning conforming to [506.2.5](#) and as follows:
 - Use the size, number, type, and configuration of hardened flat washers the DTI manufacturer recommends for bolt diameters greater than 1 1/8 inches.
 - Ensure that the supplier pre-assembles each bolt/nut/washer assembly before shipping.
 - Ensure that bolt/nut/washer assemblies are accompanied by a certified report of test or analysis giving the results of the supplier's rotational-capacity testing. No field rotational-capacity testing is required.
 - Ensure that bolt/nut/washer assemblies are shipped in sealed and labeled containers.
 - Furnish 3 or more additional bolt/nut/washer assemblies of each rotational-capacity lot for pre-installation testing.
 - Submit 2 or more additional bolts and 3 or more additional nuts and washers from each lot and heat for department mechanical testing. The contractor need not submit components from a lot and heat the department previously approved.

641.2.2.2 Direct Tension Indicating Washers

- (1) Furnish zinc-coated direct tension indicating (DTI) washers conforming to ASTM F959 type 325. Ensure that DTIs have identifying marks applied by the manufacturer. Provide the engineer with 2 copies of the DTI manufacturer's instructions showing acceptable installation configurations. Provide 3 or more additional DTIs as required for pre-installation testing. Also provide the engineer with at least two 0.005-inch metal feeler gauges.

641.2.2.3 Anchor Bolts

- (1) Furnish anchor bolts conforming to ASTM F1554, grade 55 and Supplementary Specification S4, ASTM A563A heavy hex nuts, and ASTM F436 washers all hot-dip galvanized according to ASTM A153 supplemented by ASTM F2329. Over-tap galvanized nuts according to ASTM F2329.
- (2) Use only nuts and anchor bolts manufactured with sufficient clearance to allow the nuts to run freely on the bolts after coating the threads and nuts with a wax-based lubricant.

641.2.3 Grating

- (1) Provide walkway grating conforming to the plans.

641.2.4 Pipe

- (1) Provide pipe for handrail conforming to ASTM B241 alloy 6063-T6.

641.2.5 Steel Chain

- (1) Provide zinc coated carbon steel chain of the size, type, and length the plans show and include all accessories the plans show.

641.2.6 Certification

- (1) Submit a certified report of test or analysis to the engineer for the castings, columns, truss members, pipes, anchor bolts, high-strength bolts, nuts, and washers, and structural sections. The engineer must approve the material before the contractor may install in the work.
- (2) The engineer may retest materials delivered to the job site; furnish the specimens for this testing at no expense to the department.

641.2.7 Aluminum Sign Bridges

641.2.7.1 Columns, Crossarms, Truss Chords, and Braces

- (1) Provide columns, crossarms, truss chords, and braces made of extruded aluminum tubing conforming to ASTM B221, alloy 6061-T6. Ensure the tubing is free from discoloration, nicks, and blemishes resulting from improper packing and handling.

641.2.7.2 Aluminum Plates

- (1) Provide plates and sheets conforming to ASTM B209, alloy 6061-T6.

641.2.7.3 Aluminum Structural Shapes

- (1) The contractor may use rolled or extruded standard structural shapes conforming to ASTM B308, alloy 6061-T6.

641.2.7.4 Aluminum Washers

- (1) Provide washers conforming to ASTM B209, alloy 2024-T4. For aluminum spring lock washers, conform to ASTM B211, alloy 7075-T6.

641.2.7.5 Aluminum Shims

- (1) Provide shims conforming to ASTM B209, alloy 1100-0.

641.2.7.6 Castings

- (1) Provide material for post bases conforming to ASTM B26, alloy 356-T6. Furnish splicing flange material, if cast, conforming to ASTM B26, alloy 356-T7. Provide material for post caps, if cast, conforming to ASTM B26, alloy 356-F.

641.2.7.7 (Vacant)

641.2.7.8 Stainless Steel Bolts and Nuts

- (1) Provide stainless steel set screws, bolts, nuts, and washers, for base plate clamps, tower connections, and U bolts as specified for bolts and nuts in [513.2.2.5](#).

641.2.8 Steel Sign Bridges

- (1) Furnish materials conforming to the following:

Structural Steel and Miscellaneous Metals[506.2](#)

Delete 641.2.8(2) to eliminate steel specifications that are in the plans.

- (2) Furnish sign bridge trusses, columns, and steel accessories zinc coated according to ASTM A123, the zinc coating must withstand 8 one-minute dips in the Preece test solution, ASTM A239.

641.2.9 Overhead Sign Supports

- (1) Submit shop drawings identified by structure number, design computations, and material specifications, to the engineer before erecting sign supports. Provide tightening procedures for mast arm or luminaire arm to pole shaft connections on the shop drawings. Have a professional engineer registered in the state of Wisconsin sign, seal, and date the shop drawings and certify that the design conforms to AASHTO standards and the contract.
- (2) Provide steel pole shafts and mast arms zinc coated according to ASTM A123. Provide tapered pole and arm shafts with a minimum taper of 0.14 inch per foot for single-member vertical and single-member horizontal structure components. Provide bolts and other hardware conforming to [641.2.2](#).

641.3 Construction

641.3.1 General

641.3.1.1 Methods

- (1) Use construction methods for this work, including fabrication, inspection, erection, mill test reports, and shop drawings, conforming to [506.3](#). Construct concrete footings conforming to [636](#). Cure exposed portions of concrete footings as specified in [502.3.8.1](#). Wait until the concrete has attained 3500 psi compressive strength or 7 equivalent days as specified in [502.3.10](#) before erecting any portion of the structure on the footing.

641.3.1.2 High-Strength Bolts

641.3.1.2.1 Handling and Storage

- (1) Store bolts/nut/washer assemblies and DTIs in closed containers in a protected shelter to protect them from dirt and moisture until used. Maintain fastener system components as nearly as possible in the as-

manufactured condition until installed. Remove from storage only as needed and promptly return unused components to storage.

641.3.1.2.2 Pre-installation Testing

- (1) Notify the engineer before performing the required field pre-installation testing.
- (2) Lubricate high-strength bolt threads with a wax-based lubricant before testing. Test bolt/nut/washer assemblies with DTIs in all the configurations used for installation.
- (3) Perform pre-installation testing in the field conforming to the procedures enumerated in department form [DT2322](#) for bolt/nut/washer assemblies of each rotational-capacity lot with DTIs in each installation configuration. Provide the engineer with the test results by submitting 2 copies of department form [DT2322](#).

641.3.1.2.3 Bolt Installation

- (1) Do not begin bolt installation without the engineer's approval.
- (2) Lubricate high-strength bolt threads with a wax-based lubricant before installation.
- (3) Tension high-strength bolts using DTIs. Install the DTI on the bolt with the protrusions facing away from the connected materials. Install bolt/nut/washer assemblies with DTI washers in the same configuration used for pre-installation testing.
- (4) Tighten conforming to department form [DT2322](#) to provide the correct installation tension. During the operation, ensure no rotation of the part not turned by the wrench. Snug systematically from the most rigid part of the connection to the free edges. Repeat until the full connection is in a snug condition and the faying surfaces are in firm contact. Systematically tighten the connection required number of refusals is achieved. If the gaps on the DTI are completely closed, discontinue tightening.
- (5) Perform QC testing as specified in [506.3.12.3.3.3](#) for tensioning with DTIs. After observing at the initial QC testing frequency, the engineer may decide to observe QC testing at a reduced frequency. The engineer may verify bolt installation by periodically testing with a feeler gauge.

641.3.1.3 Anchor Assembly

- (1) Install structures on anchor bolts conforming to the procedures enumerated in department form [DT2321](#). Complete department form [DT2321](#) for each structure. Indicate the parties responsible for the installation and submit the form to the engineer for inclusion in the permanent project record.

641.3.1.4 Sign Installation

- (1) Install permanent signs as soon as support structures are erected. If permanent signing is not available, install sign-blanks to control vibration. Fasten to the supporting structure conforming to [637.3.3.3](#).
- (2) For overhead sign supports, ensure that sign-blanks are the same sizes and at the same locations as the permanent signs.
- (3) For sign bridges, attach sign-blanks to a minimum of 1/4 the truss length near its center. Use sign-blanks that are at a minimum 24 inches larger than the truss depth and project an equal distance beyond the top and bottom chord members.
- (4) Install structure identification plaques on overhead sign supports and sign bridges in the locations the plan details show.

641.3.2 Aluminum Sign Bridges

- (1) Under the Sign Bridge Single Pole Sign Support One Sign bid items, furnish and erect single pole sign supports with attachments for signs facing in one direction.
- (2) Under the Sign Bridge Single Pole Sign Support Two Signs bid items, furnish and erect single pole sign supports with attachments for signs facing in opposite directions.
- (3) Under the Sign Bridge Cantilevered bid items, furnish and erect cantilevered sign bridges with a single supporting structure.
- (4) Under the Sign Bridge Structure Mounted bid items, furnish and erect sign bridges mounted on overhead roadway bridges.
- (5) Under the Sign Bridge bid items, furnish and erect sign bridges with multiple supporting structures.

641.3.2.1 Fabrication

- (1) Fabricate according to the Aluminum Association's specifications for aluminum structures.

641.3.2.2 Bending

- (1) The engineer will allow bending only for plates used for hand holes, as the plans show.

641.3.2.3 Welding

641.3.2.3.1 General

- (1) Perform all shop welding for aluminum sign bridges and supports as the plans show and conforming to AWS D 1.2, Structural Welding Code - Aluminum.
- (2) Do not weld in the field without the engineer's written approval. The engineer will only allow field welding for repairs in noncritical locations and when a department-approved individual competent to perform inspections is present during the welding.
- (3) The welding terms used in these specifications are defined in AWS Welding Terms and Definitions (AWS A 3.0) of the American Welding Society.
- (4) Use welding symbols on plans conforming to "Symbols for Welding and Nondestructive Testing" published by the American Welding Society. Use added notes or details to fully explain special conditions.
- (5) Weld aluminum alloys using the gas metal-arc or the gas tungsten-arc process. The contractor may use other processes, with the engineer's approval. Use material for permanent backing that is at least equivalent in weldability to the base metal being welded.

641.3.2.3.2 Shielding Gases

- (1) For shielding gases, use welding grade or better. For gas metal-arc welding use argon, helium, or a mixture of the 2 (approximately 75 percent helium and 25 percent argon). For gas tungsten-arc welding done with alternating current, use argon. For gas tungsten-arc welding done with direct current, straight-polarity, use helium. Use hoses made of synthetic rubber or plastic. The engineer will not allow use of natural rubber hose. The engineer will not allow hose used previously for acetylene or other gases.

641.3.2.3.3 Preparing the Materials

- (1) Make joint details according to design requirements and detail drawings. The contractor shall not change the locations of joints without the engineer's approval.
- (2) Perform edge preparation by sawing, machining, clipping, or shearing, except mill the ends of tubular members to a close fit, making the opening a maximum of not more than 1/16 inch. The contractor may use gas tungsten-arc, or gas metal-arc cutting. Ensure that cut surfaces conform to the ANSI surface roughness rating value of 250. The engineer will not allow oxygen cutting.
- (3) Ensure that surfaces and edges being welded are free from fins, tears, and other defects that would adversely affect the weld quality.
- (4) Remove dirt, grease, forming or machining lubricants, or any organic materials from the areas being welded by cleaning with a suitable solvent, or by vapor degreasing.
- (5) Deoxidize all edges and surfaces being welded by a process acceptable to the engineer. If using wire brushing, use stainless steel brushes. The contractor shall not use hand power-driven wire brushes that were used on other materials, on aluminum. If mechanical methods of oxide removal are inadequate, use a standard chemical method. Perform welding within 24 hours after chemical treatment. If using gas tungsten-arc welding with direct current, straight-polarity, then remove the oxide from all edges and surfaces being welded by a standard chemical method.
- (6) The contractor shall not weld anodically treated aluminum unless it removes the condition from the joint area being welded.

641.3.2.3.4 Inspection

- (1) Visually inspect all welds; additionally, the engineer may subject all butt welds in main, stress-carrying members of highway sign bridges subject to tension or stress reversal, as the engineer determines, to radiographic or ultrasonic testing over the entire length of the weld. For highway sign structures, inspect by the dye penetrant method on fillet welds connecting columns to bases and main chord members, including the associated flanges, gussets, or main load carrying brackets or members, and on fillet welds connecting flanges to the main truss chord members. Perform the dye penetrant tests according to ASTM E165, visual dye solvent removable.

641.3.2.3.5 Corrections

- (1) Instead of rejecting an entire piece or member containing welding that is unacceptable, the engineer may allow the following corrective measures, whose approval is required before making each repair.
- (2) Correct defective welds by removing and replacing the entire weld, or as follows:
 1. For cracks in welds or base metal: Determine full extent of crack by dye penetrant method or other positive means. Remove crack throughout its length and depth, and reweld.
 2. For excessive porosity, lack of fusion: Remove defective portions and reweld.
 3. For copper or tungsten inclusions: Remove defective portions and reweld.
 4. For excessive concavity or crater, undercut, undersize welds: Clean and deposit additional weld metal.
 5. Overlap: Reduce by removing excess weld metal.
- (3) Remove the defective areas by chipping or machining. The contractor shall not use oxygen cutting. Before rewelding, the engineer will inspect the joint to ensure removal of the entire defective weld. If using dye penetrant to inspect the weld, remove all traces of penetrant solutions with solvent, water, heat, or other suitable means before rewelding.

641.3.2.3.6 Qualifying Procedures, for Welders and Welding Operators

- (1) Before performing joint welding procedures, pre-qualify the procedure using methods specified in AWS D 1.2, AWS Structural Welding Code - Aluminum at no expense to the department. The engineer may accept evidence of previous qualification of the joint welding procedures being used.
- (2) Hire only welders and welding operators to perform work under these specifications that were qualified previously by tests specified in AWS D 1.2, Structural Welding Code - Aluminum. The engineer may accept evidence of previous qualification of the welders and welding operators the contractor employs. Use the same process and type of equipment required to execute work, to qualify the welders and welding operators.

641.3.2.4 Handling, Storing, and Erecting

- (1) In handling the aluminum truss section and trusses, use covered chains or steel cables to lift or move them. Handle this material in a way that does not permanently damage them.
- (2) Store aluminum material, either plain or fabricated, above the ground on platforms, skids, or other suitable supports. Keep the material free from grease, dirt, and contact with dissimilar metals.
- (3) Before laying out or working on, ensure all material is straight. If straightening is necessary, perform it by methods that will not injure the strength or appearance of the metal. The engineer will reject material with sharp kinks or bends.
- (4) Assemble all the truss sections that make up any one sign bridge in the shop, and adjust to the proper alignment and camber as the plans show. Matchmark all truss sections and shims before disassembly. In the field, assemble the truss sections on the ground, and erect on the columns in one piece.
- (5) Erect the columns on the leveling nuts to a true vertical position and then securely tighten the top nuts to the casting, allowing for approximately 3 inches of grout under the casting. Coat the anchor bolt holes in the casting, and the top of the base under the anchor bolt washers with an engineer-approved aluminum impregnated caulking compound.
- (6) The contractor shall not erect aluminum sign bridges until after attaching the required dampeners.

641.3.3 Steel Sign Bridges

- (1) Perform all shop welding for steel sign bridges and supports as the plans show and conforming to AWS D 1.1, Structural Welding Code - Steel.
- (2) Do not weld in the field without the engineer's written approval. The engineer will only allow field welding for repairs in noncritical locations and when a department-approved individual competent to perform inspections is present during the welding. Perform field welding using personnel qualified under AWS D 1.5, Bridge Welding Code.
- (3) Inspect all welds visually, additionally, if the engineer determines, test all butt welds in main, stress-carrying members subject to tension or stress reversal by radiographic or ultrasonic methods over the entire length of the weld. Test other butt welds in these members by the same methods, except the engineer will determine the length of weld to test. Use either the dye penetrant method, or the magnetic particle method to test the fillet welds described in [641.3.2.3.4](#). Perform the dye penetrant test according

to the method described in [641.3.2.3.4](#) and perform the magnetic particle method according to the applicable requirements of ASTM E709. Furnish all materials, equipment, and personnel to perform this inspection at no expense to the department.

- (4) Blast clean and then zinc coat the fabricated sign bridge trusses, columns, and their steel accessories after completing all cutting, punching, drilling, and welding.
- (5) After zinc coating, assemble the individual members making up the truss sections, unless fabricated and zinc coated in one piece in the shop, adjust to the proper shape and alignment, and tighten the high-strength bolts to the required tension. Provide a certificate of compliance certifying that high-strength bolts within truss sections are tensioned conforming to [506.3.12](#). Then, assemble the truss sections that make up any one sign bridge in the shop, and adjust to proper alignment and camber as the plans show. Matchmark all truss sections and shims before disassembling for shipment.
- (6) Assemble the sections making up the truss, together as a single unit, before attaching to the columns.
- (7) Protect zinc coated members from damage to the zinc coating during transportation, storage, and erection. Paint areas of damaged zinc coating with 2 coats of zinc dust/zinc oxide paint. Clean damaged and adjacent areas by sanding, scraping, chipping, or wire brushing. Apply a profile to the bare metal surface using a needle gun before painting. For areas of damage larger than 10 square inches metalize according to AASHTO M36 or, for field repairs, using an engineer-approved high-temperature application of zinc powder and flux in paste or stick form.
- (8) Construct the aluminum handrail, including fabrication and erection, as specified for aluminum sign bridges in [641.3.2](#).

641.3.4 Overhead Sign Supports

Revise 641.3.4(1) to eliminate aluminum. The department no longer builds aluminum overhead sign supports.

- (1) Under the Overhead Sign Support bid item, furnish and erect commercially designed sign supports, fabricated from steel, consisting of pole shafts, mast arms, anchor bolts, hardware, concrete supports and all other items necessary to complete the work.
- (2) Construct the sign supports according to the manufacturer's instructions.

641.4 Measurement

- (1) The department will measure the Sign Bridge Single Pole Sign Support One Sign, Sign Bridge Single Pole Sign Support Two Signs, Sign Bridge Cantilevered, Sign Bridge Structure Mounted, and Sign Bridge bid items as a single lump sum unit for each sign bridge acceptably completed.
- (2) The department will measure the Overhead Sign Support bid items as a single lump sum unit for each overhead sign support acceptably completed.

641.5 Payment

- (1) The department will pay for measured quantities at the contract unit price under the following bid items:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
641.0100	Sign Bridge Single Pole Sign Support One Sign (structure)	LS
641.0600	Sign Bridge Single Pole Sign Support Two Signs (structure)	LS
641.1200	Sign Bridge Cantilevered (structure)	LS
641.5100	Sign Bridge Structure Mounted (structure)	LS
641.6600	Sign Bridge (structure)	LS
641.8100	Overhead Sign Support (structure)	LS

- (2) Payment for the Sign Bridge Single Pole Sign Support One Sign, Sign Bridge Single Pole Sign Support Two Signs, Sign Bridge Cantilevered, Sign Bridge Structure Mounted, and Sign Bridge bid items is full compensation for providing all materials; for anchor bolts; for high-strength bolt/nut/washer assemblies and DTIs including those required for testing; for dampeners if required in the structure plans; for fabricating, including all cutting, preparing, welding, and zinc coating; for transporting and erecting; for structure identification plaques; and for sign blanks if required. Concrete footings are paid for separately as specified in [636.5](#). Signs and the sign mounting system are paid for separately as specified in [637.5](#).
- (3) Payment for the Overhead Sign Support bid items is full compensation for designing the sign support structure; for excavating; for providing all materials, including anchor bolts, pole shafts, mast arms, required reinforcing steel, and concrete; for high-strength bolt/nut/washer assemblies and DTIs including those required for testing; for fabricating, including all cutting, preparing, welding, and zinc coating; for

placing and curing concrete footings; for transporting and erecting; for structure identification plaques; and for sign blanks if required. Sign lighting, when required, is paid for separately as specified in [659.5](#). Signs and the sign mounting system are paid for separately as specified in [637.5](#).